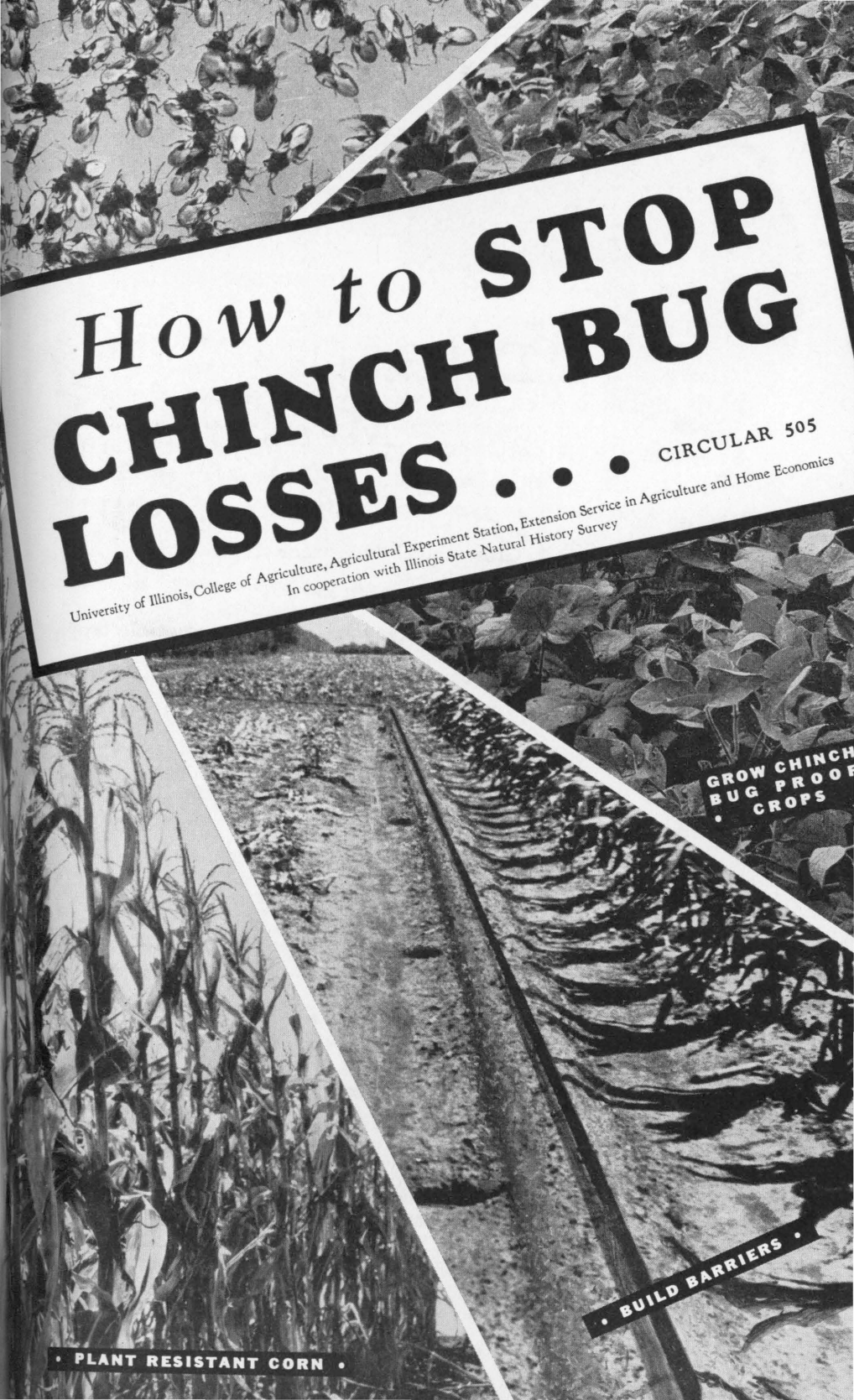

How to STOP CHINCH BUG LOSSES . . .
CIRCULAR 505
University of Illinois, College of Agriculture, Agricultural Experiment Station, Extension Service in Agriculture and Home Economics
In cooperation with Illinois State Natural History Survey
• GROW CHINCH BUG PROOF CROPS
• BUILD BARRIERS •
• PLANT RESISTANT CORN •

Chinch bugs, natural size

Defense Measures

- Grow chinch-bug-proof crops
- Adjust the rotation
- Grow resistant varieties of susceptible crops
- Use barriers and traps

The cheapest and most effective method of fighting this pest is the use of chinch-bug-proof crops.

•

This Circular replaces Circular 431

Cooperative Extension Work in Agriculture and Home Economics: University of Illinois, College of Agriculture, and the United States Department of Agriculture cooperating. H. P. Rusk, *Director*. Distributed in furtherance of the Agricultural Extension Act approved by Congress May 8, 1914.

Urbana, Illinois May, 1940

How to Stop Chinch Bug Losses

By W. P. FLINT, G. H. DUNGAN, and J. H. BIGGER[1]

WEATHER MAIN FACTOR IN ABUNDANCE

OF ALL the factors affecting the abundance of chinch bugs, weather is by far the most important. Chinch bugs are often said to be dry-weather insects, but much depends on the time of year when the dry weather occurs. Heavy rains in the early spring may have little or no effect on the bugs, but frequent heavy rains during the last half of May and June will reduce infestations, and even in years of greatest abundance will keep down the numbers to a point where no serious damage will occur: The rain beats down the young bugs and "muds" them in so they die. Also dampness and high humidity favor the natural spread of the white fungus disease which attacks the insects but cannot be effectively spread artificially.

Again, if a period of very wet weather occurs in August, starting about the first of the month and continuing thruout the month, the second brood of chinch bugs will be greatly reduced and usually this means no damage the following year.

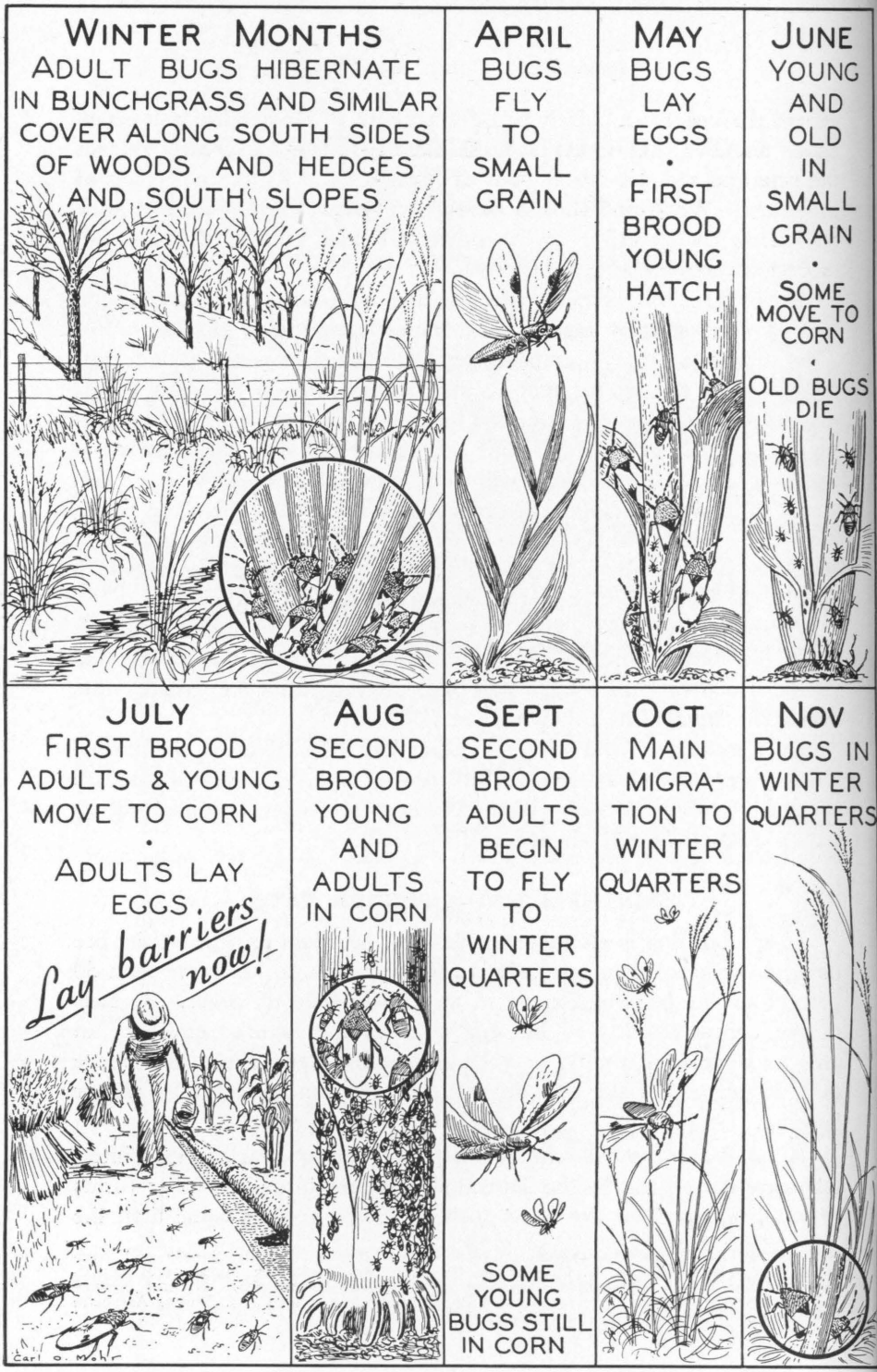
Even extremely cold winter weather has little effect on this insect. Twenty degrees below zero will kill few, if any, of the bugs that are protected in their normal winter quarters. Mortality in winter hibernating quarters is only about 6 to 10 percent.

WINTER BURNING SELDOM PAYS

If any burning is attempted, care must be taken to prevent the fire doing more harm than good. It is rarely possible to kill more than 50 percent of the bugs sheltering in any given type of cover. Because of the impracticability of burning over all the favored cover in an area as large as a county, or even a township, it is doubtful if more than 25 percent of the bugs in such an area can be killed by winter burning.

What Not to Burn.—In burning hibernating quarters in winter, take care not to destroy the natural shelters for birds and other forms of wildlife, for these are likely to be of much greater value than the

[1]W. P. FLINT, Chief Entomologist, Illinois State Natural History Survey and Agricultural Experiment Station; G. H. DUNGAN, Chief in Crop Production, Agricultural Experiment Station; and J. H. BIGGER, Associate Entomologist, Illinois State Natural History Survey. For the drawing on page 4 the authors are indebted to C. O. MOHR, Associate Entomologist of the Illinois State Natural History Survey.



Only when chinch bugs are migrating from small grain can enough be killed or diverted to help save a threatened corn crop

benefit derived from chinch bug destruction. Do not burn well-established stands of bluegrass, because burning old grass greatly retards the rate and reduces the amount of growth made by the new crop of bluegrass. **Woodland should never be burned,** as the damage done by killing the young growth and destroying wildlife shelters will more than offset the benefit gained.

KNOW BUG'S HABITS AND HABITAT

To be able to use most effectively the best methods for fighting the chinch bug, one must know how it goes thru the different seasons, and where. The life history of this insect is simple compared with that of many others.

October to April. From about mid-October until about the middle of April the full-grown chinch bugs are hidden in various sheltered, well-protected places. They do not feed during this period and consequently do no damage. Their favorite shelters are bunch grasses (including prairie grass), broom sedge, bluestem, and other native and cultivated grasses that form dense bunches or clumps. On south slopes along roads, south sides of ditch banks and hedges, and the south and west exposures of woodlands, the bugs are especially abundant in these grasses. Large numbers occasionally infest other types of shelter—around buildings, under loose bark of trees and posts, in accumulations of some types of trash, and under leaves of mullein and other plants. They rarely penetrate more than 10 or 15 rods into the denser woodlands. Only a comparatively few bugs hibernate in cornstalks.

April, May, early June. Overwintered bugs and their young are found at this time in fields of small grain or tender, succulent grasses. It is during this period that the flight out of winter quarters occurs. This flight does not always come at the same date in a given locality, nor do the bugs all fly out on a single day—they start leaving winter quarters when there have been several hours of bright sunshine at temperatures of about 70° F. or above. If the weather suddenly cools, the flight ceases, and a week or ten days may elapse before conditions again stir the rest of the bugs out of their winter quarters and start them flying to the fields of small grain.

Once in the fields the bugs feed for a time, and then start laying their eggs. A female lays 15 to 20 eggs in one day and may not lay again for several days. Mating and egg-laying usually go on for about a month, the young from the first-laid eggs often being nearly grown by the time the last eggs are laid.

Late June, early July. By the middle of June most of the old bugs are dead. The first-hatched bugs are mostly in the immature stage. When the small grain dries up or is cut the latter part of June and July, the bugs migrate on foot to fields of corn. *It is only during this migration that barriers are effective.* Very shortly the bugs acquire wings, a general flight takes place, and the bugs scatter over the cornfields, usually picking the thinner stands of corn in order to avoid dampness and shade.

July, August, September. During these months the bugs from the first brood stay in the cornfields, where the second brood is produced.

August-October. The flight from the cornfields to winter quarters starts about the last of August and is completed about mid-October. The second brood develops almost entirely at the expense of the corn.

Two to three broods. Thus there are two broods of the bugs in most years, one maturing in the small grain during late spring and the other developing in the corn during the summer. In very dry, hot years there may be a partial third brood in late summer.

IMMUNE CROPS ARE BEST WEAPON

Of all methods of fighting the chinch bug, the cheapest and most effective is the use of crops that are immune to attack. These include such crops as:

Alfalfa	Cowpeas	Sugar beets
Red clover	Soybeans	Artichokes
Sweet clover	Sunflowers	Potatoes
Alsike clover	Flax	Rape
Lespedeza	Buckwheat	

The chinch bug has never been known to develop on any plant that does not belong to the grass family and, so far as is known, no member of the grass family is chinch-bug-proof. Fortunately for the farmer not all crops of the grass family are equally favored by the chinch bug. Among the small grains, for instance, *barley,* both winter and spring, is most liked. It is therefore a hazardous crop in most parts of the state if the bugs are at all numerous. Other small grains ranked in about the order in which the chinch bug chooses them, are: *spring wheat, spelt, wheat, oats,* and *unpastured rye.* Where rye is thinned by pasturing, it will become heavily infested. All grass weeds such as *foxtail, barnyard grass, tickle grass,* and *quack grass* serve as pasture for the chinch bug.

The clovers, alfalfa, soybeans, in fact all crops except the grasses, are chinch-bug-proof. They offer the farmer his best protection against chinch bug losses. Corn, millet, Sudan, and the sorghums all belong to the grass family.

The larger-growing grass crops are favored by the chinch bug in about the following order: *Sudan grass, millet, corn, sorgo, broomcorn,* and *grain sorghum.* Smaller-growing grasses commonly used for hay or pasture are not much fed upon.

A heavy stand of grain of any variety is avoided by the bugs. A dense growth of clover in small grain discourages them and helps to prevent damage.

CROP ROTATIONS TO REDUCE DAMAGE

As has been stated, the bugs of the first brood depend for their food mainly on small grain, especially *wheat, oats, barley,* and *rye,* and the second brood feeds almost exclusively on *corn.* It naturally follows that a good way to hold this insect in check is to make its food scarce sometime during the growing season, growing as large an acreage as possible of the crops on which it does not feed. Weather conditions in May and June *may* destroy the chinch bugs, but this may not happen until after corn planting.

In heavy corn-producing areas the acreage in small grains should be reduced. A rotation of corn, soybeans, wheat or oats, and clover will suffer as little loss as any rotation that contains a small grain and corn.

FARM ESPECIALLY SUITED TO CORN

Corn	20 percent	Oats (or wheat)	20 percent
Soybeans	20 percent	Clover	20 percent
Corn	20 percent		

In the corn belt it is necessary, in some years and on some farms, to sow oats or wheat next to corn if the rotation is not to be broken. Under such conditions a creosote barrier must be maintained between the small grain and the corn while the chinch bugs are migrating from the small grain. In years when chinch bugs are abundant, soybeans may be planted in corn at the rate of two beans to each hill of corn (*see page 9*). In such years, strains of corn resistant to second-brood bugs should be planted if possible.

WHERE LESS CORN IS NEEDED

Wheat (or oats)	25 percent	Corn	25 percent
Clover	25 percent	Soybeans	25 percent

This rotation is recommended for those farms in the southern three-fifths of the state on which winter wheat is commonly grown and on which the soil is in condition to produce good crops of wheat.

Neighborhood cooperation. Neighbors may well cooperate by planting corn in adjoining fields. When both small grains and corn are grown on the same or on adjoining farms, the fields of these two crops should preferably not be adjacent to each other. Small irregular fields should be eliminated wherever possible, as they make control by barriers difficult.

RESISTANT OPEN-POLLINATED CORNS

There is no variety of corn that can withstand the onslaught of a horde of ravenous first-brood bugs traveling on foot from adjoining fields of small grains; barriers must be used to protect corn from them. But some varieties can withstand the feeding of the second brood and still produce a reasonably good crop of grain. What makes some strains more resistant to injury than others is not known. It is not a matter of the bugs being repelled, for there is no appreciable difference between the number of insects on a strain that is resistant and one that is susceptible.

Several varieties of open-pollinated corn have proved resistant to chinch bug damage—some of these are:

Champion White Pearl (sometimes called Democrat)
Pride of Saline
Golden Beauty
Black Hawk
Mohawk
Waddell Utility White Dent
Waddell Utility Yellow Dent
Moore Yellow Dent (somewhat resistant)

These varieties are adapted to southern and south-central Illinois.

Photograph, page 9, furnished by J. R. Holbert, formerly with Bureau of Plant Industry, U.S. Department of Agriculture.

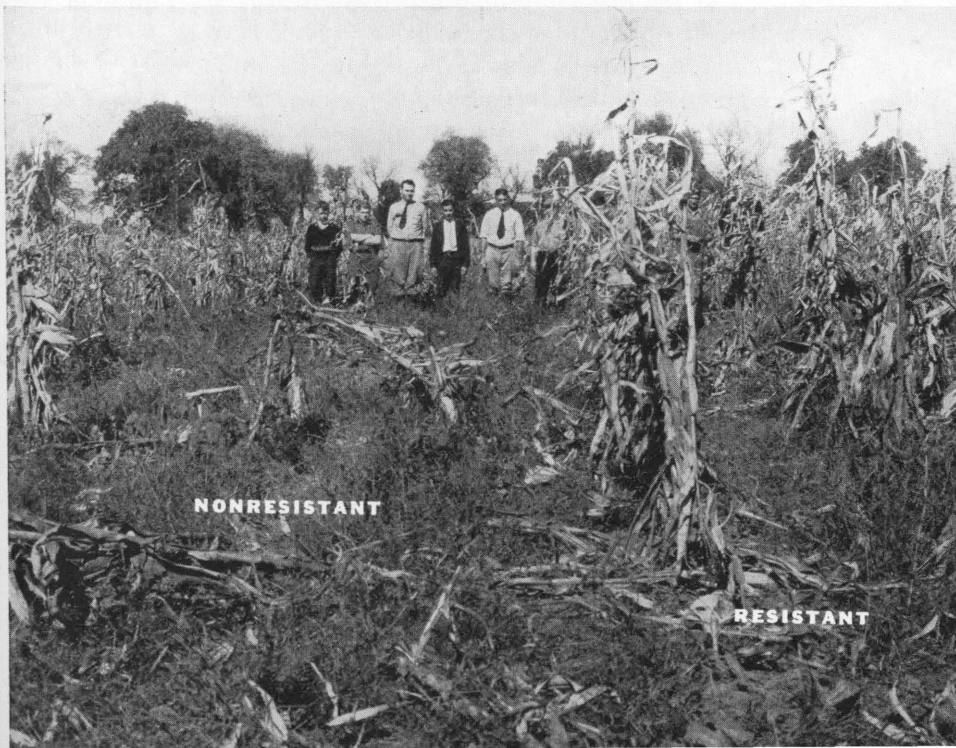
RESISTANT CORN HYBRIDS

Because of the rapid change in hybrids from year to year no extensive recommendations can be made as to those that are especially desirable from the standpoint of resistance to second-brood chinch bugs. In southern Illinois, Illinois Hybrids 863, 877, 885A, 156, and 450 have proved resistant. For the central part of the state it is possible to say that Illinois Hybrids 960 and 710, when grown on good soil, showed resistance in 1936. In the northern part of this area Illinois Hybrids 126, 384, and U. S. Hybrid 5 were very satisfactory under chinch bug infestation. For the northern part of the state, Illinois Hybrids 384 and 546 should be fairly satisfactory, tho they have been tested only in a limited way under chinch bug conditions.

Hybrids having some combination of Inbreds 38-11, Hy, K_4, Kys, and Pr as parents are most likely to show resistance to chinch bugs. Those having Inbreds A, 187-2, 4-8, or L317 are likely to show susceptibility.

In general well-adapted vigorous hybrids will survive chinch bug attack better than poorly adapted hybrids or those of low vigor. Corn growing on well-treated fertile soil has the best chance to survive.

Differences in hybrids were well demonstrated on this plot. Corn on left was planted the same day and cultivated in exactly the same manner as that on the right. Second-brood bugs practically destroyed the nonresistant strain; the other gave a good yield.



See Illinois Bulletin 440, the 1937 report of the corn performance tests, for further information and recommendations about hybrids and their resistance to chinch bugs. The data given there apply especially to south-central and southern Illinois. The records from Alhambra and Edgewood give the most valuable information.

When seed of resistant adapted hybrid corn is not available for the northern corn-growing area, farmers will do well to choose the best adapted and most vigorous strain and plant it only on good soil. This is better than trying to grow unadapted varieties or hybrids from southern Illinois.

Under heavy infestation in central Illinois the southern resistant varieties will stand up better and perhaps yield a little more corn than local more-susceptible varieties; but the growing of southern corns in central Illinois involves considerable hazard, as these varieties mature later, and unless they are planted early on fertile soil they may be caught by frost in the fall.

PLANTING PRACTICES CUT DAMAGE

Soybeans with corn reduce damage. Planting soybeans in the hill with corn is a good way to reduce second-brood chinch bug damage. The soybean plants hold the morning dew and the moisture after rains, thus making an unfavorable environment for the bugs. Under normal conditions soybeans grown with corn reduce the yield of corn; but even in moderate infestations of chinch bugs the benefit derived from the beans more than counterbalances their harm.

Planting the corn in hills and using two or three beans to the hill gives better results than drilling.

The planting of a crop such as pumpkins or rape in the corn will also lessen the damage from chinch bugs by providing heavy shade for the lower part of the corn plant.

Grass in corn is of some benefit. Weeds of the grass family growing in a cornfield serve to some extent to protect corn plants from chinch bugs. Labor of cultivation may be saved and an increase in the yield of corn be gained by allowing such weeds as foxtail and barnyard grass to grow in the corn, since chinch bugs seem to prefer these grasses to corn. Weeds of other types have no value for this purpose, and withholding the last cultivation to permit smartweed and pigweed to grow will only reduce corn yields.

Thick planting of corn desirable. In thickly planted corn chinch bugs do less damage than in thin plantings. In areas where chinch bugs are numerous it is therefore recommended that corn be checked a little thicker than under normal conditions.

BARRIERS TO STOP MIGRATION

The migration of chinch bugs in late June and early July from fields of small grain, where the first-brood bugs have hatched, to fields of corn or uninfested small grains, can be largely stopped by properly constructed barriers. The dirt-ridge creosote barrier and the treated paper-strip barrier have proved the most effective and are the least expensive.[1] Besides stopping the bugs from traveling from one crop to another, they make it possible to trap and kill great numbers of bugs.

Whether the paper-strip creosote barrier or the dirt-ridge creosote barrier is used, it is usually made by throwing up a ridge of earth between the infested field and the field to be protected. Paper barriers may be made on level ground.

CHEMICALS RECOMMENDED

The best materials for barriers are those that have a strong odor of creosote, cresylic acid, or naphthalene. These are found in certain grades of *crude creosote, naphthalene, naphthalene drain oils,* and to some extent in *pine-tar oils.* Such barriers are much more lasting and are less affected by blowing dust, rain, and wind than are dusty furrows or road-oil barriers. The odor of these materials is so repellent that the bugs will turn back before they will cross the barrier.

In ordering creosote for chinch bug barriers it is recommended that the specifications of the American Wood Preservers Association be used.

TREATED PAPER-STRIP BARRIER BEST

The paper-strip barrier is the most effective and least expensive method yet devised for cutting off first-brood chinch bugs between fields of small grain and corn. It consists of chemically treated strips of single-faced corrugated or tar-felt (*not asphalt*) paper 4 inches wide, buried by half their width in the soil.

Tar paper or tarred felt paper for the barrier can be bought in 150- to 250-foot rolls from the lumber yard and sawed into 4-inch strips with a power saw. The strips are then soaked at least an hour in chinch bug creosote or melted naphthalene. Nine strips of the 150-foot length or six strips of the 250-foot length are required for a quarter-mile of barrier.

---

[1]There are now several companies that make chinch bug barriers. Some of these barriers are satisfactory if the manufacturer's directions are carefully followed.

Most effective, least expensive, and easiest to maintain is the treated paper-strip barrier. The 4-inch paper strip is set 2 inches deep in a narrow furrow run along the brow of the ridge. Note post-hole traps partly in bottom, partly in sloping side, of the large furrow.

Constructing the barrier. First throw up a ridge of dirt (*see directions on page 14*). Then make a narrow furrow or trench along the brow of the ridge using a disk cultivator, a shovel cultivator with all but one shovel removed, a hoe, a garden cultivator, or any other similar implement. Place the paper strips in this furrow so that 2 inches of the treated paper projects above the top of the ground. Firmly tamp the soil around the base of the paper.

Post holes are necessary for the effective working of paper barriers just as they are for the creosote dirt barrier. (*For directions for placing the post holes and treatment of trapped bugs, see page 15.*)

Two men can erect a paper barrier a quarter of a mile long in three to four hours.

Maintaining the barrier. Once the paper is in place it should repel the bugs for two or three days if it has been properly treated and the temperature is not too high. Then it will have to be freshened by the addition of more creosote. The ordinary dirt barrier requires more frequent attention.

The creosote should be applied to the top edge of the paper on the side *towards which* the bugs are coming. Two or 3 gallons of creosote are needed to renew a quarter of a mile of paper. A bucket with a hole

cut in the side (*see description, page 14*) is a good device for applying the creosote, or a tube may be soldered to the side of the bucket to make the work of application easier.

Cost of treated paper barriers. Not over 30 gallons of creosote will ordinarily be required to maintain a quarter of a mile of paper-strip barrier for the season. This is about two-thirds the amount required for the dirt ridge. Untreated paper strips cost about $2 for each quarter-mile of 4-inch barrier. At 20 cents a gallon the cost of the creosote would be $6. Total cost, $8. The cost of the materials for the creosote-dirt barrier is about $10 a quarter-mile.

Why paper barriers are more effective. Paper-strip barriers are more effective than creosote dirt barriers largely because they supply a barrier-wall as an obstacle in addition to the dirt ridge and repellent odor. The 2-inch barrier-wall prevents to a greater extent bugs being blown over the line on windy days, and it is less easily bridged by sticks, straws, or leaves. Consequently it turns back a higher percentage of bugs.

Furthermore the paper barrier remains effective for two or three days between renewals, *from the beginning,* except when temperatures are extremely high; whereas the ordinary creosote-dirt barrier requires renewal of the creosote daily.

The farmer who laid this barrier has no further question about how to stop a chinch bug advance on his cornfields. Here we see a thriving crop on one side of the barrier, complete destruction on the other. Adding a treated paper strip (page 12) makes a still better barrier.

DIRT-RIDGE CREOSOTE BARRIER

Building the ridge. The ridge of earth should be thrown up about two weeks before the small grain is to be harvested. Make the ridge 6 to 8 inches high and as smooth as possible. Leave a flat surface at least 2 inches wide at the brow of the ridge as a location for the creosote line. (Constructing the ridge some time before it is to be used permits the dirt to settle and the ridge to become more smooth than one freshly thrown up. This settling and smoothing is quite essential to the success of the barrier.)

One of the most common ways to construct a ridge is to plow a furrow around the field, throwing the dirt toward the corn. The furrow is then smoothed down with the back of a spade or section of harrow or plank drag. The post-hole traps are dug in the bottom of the furrow or partly in the sloping side. When the barrier is prepared in advance, it is an easy matter to apply the creosote as soon as the bugs start to move.

A ridge may also be thrown up with a disk cultivator. Where this is done, it will usually have to be placed between the first and second rows of corn, where the ground has been cultivated, the first row of corn being cut out before the ridge is thrown up. A small road grader is also a very good implement for making a ridge.

Placing the repellent. Always bear in mind that creosote or paper barriers must be placed at *the top* of a ridge or slope. As has been explained, these materials turn the bugs very largely because of their repellent odor. If they are placed at the bottom of a depression, the large numbers of bugs trying to get out of the field force the front line of bugs over the barrier. If the repellent material is placed at the top of the ridge, where the bugs have to climb up to it, they are repelled by the odor before they actually crawl onto the barrier, and they therefore will not be forced upon it by the bugs behind. Also fewer bugs will be blown over such a barrier than over one at the bottom of the depression.

Bucket for applying repellent. For applying the creosote or other repellent about the best method that has been worked out, considering expense and ease of application, is to punch an 8-penny nail hole in the *side* of a galvanized or tin bucket about an inch from the bottom of the bucket and directly below the point where the bail attaches. A stream of creosote flowing from such a hole will form a wide enough path (about half an inch) on the barrier ridge to turn the bugs.

All barrier materials used on a plain dirt barrier will have to be renewed at least once a day for the first several days. In renewing them, try to apply the material on the same path. The line should be

gone over every afternoon between 1:30 and 6 o'clock, as the bugs are more active in the afternoon.

Post-hole traps. To get the best results from a barrier, a line of post holes in which the bugs can be caught and killed must be maintained at the bottom of the barrier. These holes should be about 18 inches deep, and the tops should be flared and kept dusty so that the bugs will fall into them. The dust also makes it impossible for the bugs to obtain a foothold and crawl out of the holes.

The bugs in the holes should be killed every afternoon at about sundown. One of the easiest ways to do this is to pour one to two tablespoonfuls of kerosene into the hole, scattering it around over the bugs. Do not ignite the kerosene—let the bugs work it around among themselves. In this way nearly all the bugs in the hole will be killed. A tablespoonful of calcium cyanid *flakes* (not dust) may be substituted for the kerosene. The only drawback to its use is its expense.

Narrow strips of calcium cyanid flakes placed at right angles to the creosote barrier and at intervals of 1 to 5 rods (depending on number of bugs) will kill the bugs effectively. These strips should be 2 inches wide and 10 to 12 inches long. They must be renewed daily.

Cost of creosote. Thirty-five to 50 gallons of creosote, naphthalene drain oil, or other effective material is usually required for a quarter-mile of barrier. This amount will provide for renewals for as long as a barrier is necessary, which is usually 14 to 18 days.

An acre of corn saved will usually more than pay for the maintenance of a quarter of a mile of barrier. Where the maximum amount of material is used—that is, 50 gallons for 80 rods of line—the material will cost $10 at 20 cents a gallon. The labor cost will be a little more than the cost of materials. If the bugs are really to be stopped, the time of a man or boy will be required for every half-mile of barrier from 1:30 to 6 o'clock every afternoon while the barrier is maintained.

SPRAYING AND DUSTING

Spraying is not practical on a field scale, as it will cost from $20 to $30 an acre. But where large numbers of chinch bugs are gathered on the outer rows of corn, sprays may profitably be used. An efficient spray is made by using ½ ounce of 40-percent nicotine sulfate in 1 gallon of water in which 1 ounce of any good laundry soap has been dissolved. This spray will kill all bugs that are wet by it, and it does not injure the corn unless applied in considerable amounts to the curl of the plant.

For larger quantities of spray, use 1 quart of nicotine sulfate (40-percent) to 50 gallons of water in which 3 pounds of laundry or potash fish-oil soap has been dissolved.

Poison dusts that kill by contact may sometimes be used. A dust containing 2.4 percent nicotine will not injure corn plants. This dust can be purchased, or can be made by thoroly mixing in a closed container 47 pounds of hydrated lime with 3 pounds of 40-percent nicotine sulfate. Keep tightly covered until used.

OUTBREAKS OF CHINCH BUGS occur in areas where for that year the May and June rainfall is low. Sometimes the infestation lasts five years or longer, sometimes only a single season. In the worst years practically the entire corn crop over the infested area is destroyed.

By using methods that have been well tested and are known to be effective, farmers can avoid 50 to 75 percent of this damage. Such saving may mean the difference between a farmer's having enough feed for his own stock and some grain to sell, and having to buy practically all his feed.

This circular gives full directions for combating this destructive crop pest.

10M—5-40—18724